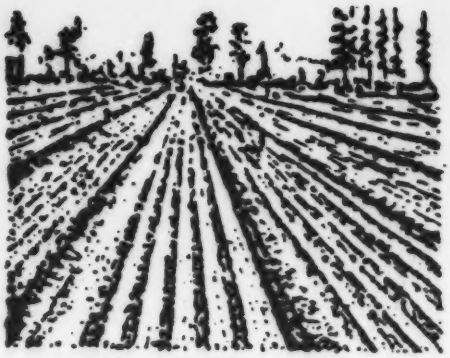

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A FIELD TEST OF 3 RED PINE AGE CLASSES

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A FIELD TEST OF 3 RED PINE AGE CLASSES

Introduction

Red pine (Pinus resinosa Ait.) plantation establishment in Ontario has been hampered by the irregular performance of bare root nursery stock. This has been attributed partly to poor field handling and planting procedures (Pierpoint et al. 1981) and partly to nursery stock quality. Red pine seedling quality can be improved by reducing seedbed density which produces a more robust seedling (Mullin 1981) and by using other improved nursery practices. Outplanting performance, on the other hand, is partly dependent upon the selection of an appropriate age class. Red pine transplant stock has in general done better in the field than seedling stock (Mullin 1980) and this has resulted in improved overall plantation performance (Mullin 1978).

In the last few years, some districts and regions have refused 3+0 stock because of inconsistent performance and poor growth. The alternative stock types have been 2+0 seedlings and 1+2 transplants.

The purpose of the experiment reported here was to compare the performance of 3+0 red pine with 2+0 and 1+2 stock under low competition conditions.

Procedure

A sample of 250 trees each of 2+0, 3+0 and 1+2 bare root red pine (site region 6200) were lifted 29 April 1981 at the Midhurst Forest Tree Nursery and planted the next day in an unused nursery compartment. An additional 100 trees per age class were lifted for stock characterization. Trees were packaged in the field in 3-ply Kraft bags with a polyethylene insert and placed in cold storage (1°C) overnight. No root pruning or water dipping was done but a handful of damp moss was added to each bag as moisture retaining material. The day of lifting was cool and cloudy with a high relative humidity.

Planting was done the next day under cool, clear conditions and high relative humidity. The site was a nutrient poor, well drained sand with little competition. Trees were planted in a randomized complete block design with 10 trees of each age class in 25 replications at a .91 m spacing. No cultivation or tending was required after outplanting.

Trees were measured 3 weeks after outplanting for initial height. Total height and annual height increment were measured at the end of each growing season. Third year height, annual height increment and survival measurements were analyzed by analysis of variance. Height was also analyzed by analysis of covariance using height at time of outplanting as the covariate. Relative height growth (Hunt 1978) was also calculated to compare third year height to initial height at time of outplanting.

Results and Discussion

The 3+0 red pine stock used in this study was typical of medium-large stock while the 2+0 stock could be classified as large (Reese and Sadreika 1979). In comparison, the 1+2 red pine was shorter but more robust than the 3+0 stock (Table 1).

Survival after outplanting was greater than 99% for each age class after 3 growing seasons. However, height growth patterns differed considerably among age-classes. The larger 3+0 and 1+2 age classes both had reduced second year height increment despite reasonably good growth in the first year, but the 2+0 red pine showed continually improved height increment each year after outplanting. This difference in terminal growth in the second year greatly reduced the original height advantage that the larger 3+0 stock had over the 2+0 stock.

After 3 years of growth in the field, the annual height increment of the 3+0 stock was still less than that obtained in its final year in the nursery. The 1+2 red pine produced third year terminals only slightly larger than that obtained in its final year in the nursery. As a result of reduced terminal growth of the 3+0 seedlings the 1+2 stock surpassed the 3+0 stock in height after the first year and steadily increased this difference in size thereafter.

The analysis of covariance of third year heights gives a measure of field performance relative to the initial size of the various age classes at time of planting. In simpler terms this analysis permits an estimation of third year heights as if all the age classes were the same height at time of planting. The adjusted heights (Table 2) show that the 2+0 stock had the best relative height growth, followed by the 1+2 and 3+0 age classes. The relative height growth after 3 years [$(cm\ cm^{-1})\ yr^{-1}$] indicated nearly a 50% yearly increase for the 2+0 red pine while the 1+2 and 3+0 stock yielded a smaller rate of increase (Table 2). On the basis of these findings, we can say that the 2+0 and 1+2 stock both outperformed the 3+0 seedling stock.

The 2+0 red pine seedlings used in this study were grown for 3+0 shipping stock and were therefore subjected to a lower seedbed density and a different fertilization schedule than seedlings grown for 2+0 shipping stock. Growers should refrain from increasing seedbed density to maximize production of 2+0 stock when the consequences of this action may reduce physiological and morphological quality.

Good 2+0 red pine stock outperforms 1+2 stock which, in turn, is superior to 3+0 stock when outplanted in an area with minimum competition. A similar response may be expected in the field, provided competition is kept under control. Under heavy competition situations; the 1+2 stock should be planted. However, it should always be kept in mind that regardless of the physiological or morphological quality of the stock produced by the nursery, poor holding practices (Racey and Hutchison 1983) or handling and planting procedures (Pierpoint et al. 1981) will result in inconsistant and unsatisfactory field performance.

References

Hunt, R. 1978. Plant growth analysis. The Institute of Biology's studies in biology No. 96. Edward Arnold Ltd., London. 67 p.

Mullin, R.E. 1978. Plantation performance averages for red pine. Ont. Min. Natur. Resour., For. Res. Note 16. 2 p.

Mullin, R.E. 1980. Comparison of seedling and transplant performance following 15 years growth. For. Chron. 56: 231-232.

Mullin, R.E. 1981. Seedbed density effects on red pine in the nursery and after outplanting. Ont. Min. Natur. Resour., Nursery Note 72. 5 p.

Pierpoint, G., J.M. Paterson, J.G. Boufford and C. Glerum, 1981. Irregular growth of outplanted red pine. VI. The influence of handling and planting on fifth year performance. Ont. Min. Natur. Resour., For. Res. Note 29. 4 p.

Racey, G.D. and R.E. Hutchison. 1983. A comparison of spring holding options for red pine. Ont. Min. Natur. Resour., Nursery Note 95. 5 p.

Reese, K.H. and V. Sadreika. 1979. Description of bare root shipping stock and cull stock. Ont. Min. Natur. Resour. 36 p.

Table 1. Morphological measurements of 2+0, 3+0 and 1+2 red pine (n=100).

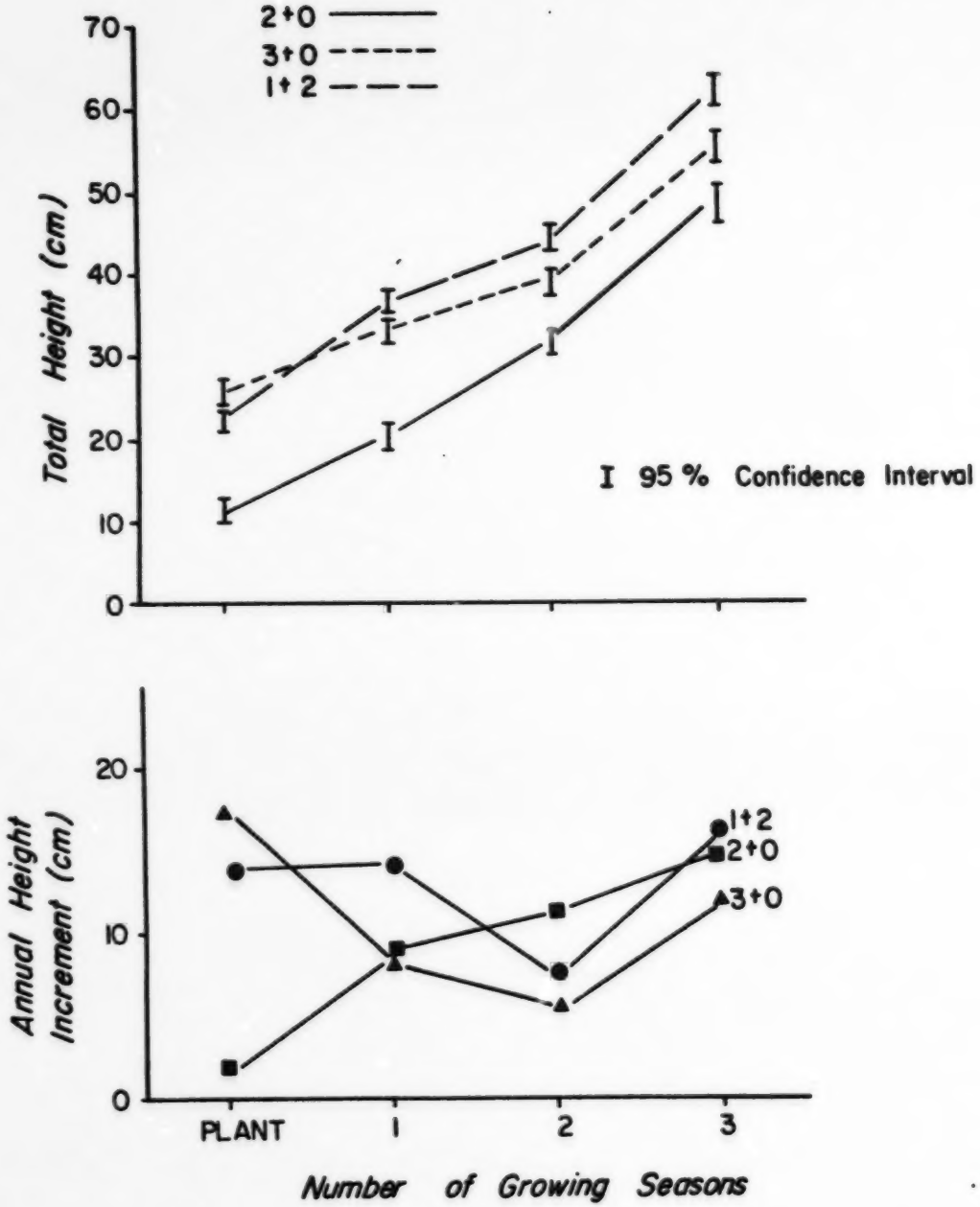
Age class	Top length cm	Stem diameter cm	Top dry weight g	Root dry weight g
2+0	10.1	.404	3.59	0.85
3+0	26.8	.501	6.65	1.75
1+2	22.2	.807	16.85	5.77

Table 2. Relative field performance as represented by the adjusted mean height for 3 red pine age classes and relative growth rate based on heights. Means were adjusted on the basis of an analysis of covariance of third year heights using the height at time of planting as the covariate.

Age class	Height at planting (cm)	Height after 3 years (cm)	Adjusted mean height (cm)	Relative growth rate (cm cm^{-1}) yr^{-1}
2+0	11.04	48.4c	71.8a	.49
3+0	25.42	55.2b	39.0b	.26
1+2	22.12	62.4a	55.2c	.35
		**	**	

** significant at 1% level

Numbers not followed by similar letters are significantly different at the 1% level.



List of Figures

Figure 1. Total height and annual height increment for 2+0, 3+0 and 1+2 red pine after each growing season.